DOCUMENT RESUME

ED 261 617 HE 018 715

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TITLE Teaching Academic Learning Skills in College Learning Improvement Programs.
PUB DATE Apr 85
NOTE 42p.; Paper presented at the Annual Meeting of the American Educational Research Association (69th, Chicago, IL, March 31-April 4, 1985).
PUB TYPE Viewpoints (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Cognitive Style; *College Students; *Decision Making; Higher Education; *Learning Strategies; Learning Theories; Models; Skill Development; *Study Skills

ABSTRACT

The use of thought modeling as an effective technique for teaching academic learning skills is examined. Based on decision theory, it is proposed that learning is improved when the student makes active decisions about learning actions or skills. Control over learning is dependent upon the quality of decisions about matching learning resources and task demands. An adequate learning skills repertoire allows learners to respond differentially to changes in external variables. A variety of learning skills appears essential. For example, in learning information, students should have several skills to organize, recall, review, and acquire information. A good skills repertoire also includes both content experience and task experience as well as sensitivity to how well the skills are being used. Cognitive or thought modeling appears to provide a good method to help students know how and when to use a skill, and how to monitor its success. Seven steps proposed by Cormier and Cormier to demonstrate and teach new thinking patterns are: a verbal set about the procedure, a cognitive model of the task and of self-verbalizations, overt external guidance, overt self-guidance, faded overt guidance, covert self-guidance, and homework. Survey skills are used as an example of the use of thought modeling. (SW)

Teaching Academic Learning Skills in College Learning Improvement Programs

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April, 1985

ABSTRACT

Effective learning in in higer education requires a learner to a creatively manipulate internal and external variables. This includes decisions on managing learning resources and learning skills to accommodate content characteristics and task demands. One important component of this decision process is a skill repertoire of adequate size and variety to allow versatile decisions about the best ways to study and learn. This paper describes how thought modeling can be an effective technique for teaching academic learning skills. General procedures are presented to guide the development of thought models and examples are given to illustrate this process.

Several years ago, a student in a junior level educational psychology class which I taught received a terrible score on a test covering a book on Piaget. I put a note on her test paper to come see me, which she did immediately. Not only was she clearly an interested and motivated student who frequently asked questions and appeared attentive, but she was also very concerned about her performance. She assured me she had read the material and could not understand why she did poorly.

I asked her how she studied. Mystified by my question, she said she had read the book and highlighted, showing me her text as proof. Aware she hadn't fully understood the material when she first read it, she read it again and, then, again. Each time she read, she highlighted, resulting in her book being completely highlighted. She even reread a fourth time and highlighted over what she had already marked in a different color. She was totally confused as to why she had not learned well.

This is a situation in which many relatively successful students find themselves, at least some times. They have succeeded with a particular way of studying but experience failure once in a while. Unfortunately, when they fail, students like these do not have any alternatives to the single study procedure they have employed. In addition, they often have no idea that there are other cognitive

actions they can use to improve their learning. Consequently, they continue to study more, although it would be more helpful to study differently.

Examples like this illustrate the learning difficulties that even bright students can experience as they attempt to learn. They do not recognize that good learners are relatively versatile, purposeful and reflective about their own learning. Pask (1976) and others indicate that good learners are often quite sophisticated personal learning theorists who regularly investigate the relation between various study actions and how much and how well they learn. Also, many students do not realize that a variety of learning skills are available which can be differentially effective and efficient given differences in content and task assignments. They fail to understand that changes in learning conditions imply they should make changes in learning skills and strategies (Sherman, in press).

A question, here, is, "Why do some students learn to study well and others do not? The answer, I think, lies in the nature of study and the special requirements of academic learning. Even special study skills courses often do not significantly improve the learning success of these students (Ford, 1980). Again, I think at least part of the reason lies in the nature of study.

An Analysis of Study

Study is a personal activity which is idiosyncratic and not easily improved through experience (Sherman, 1983). Learning is not easily observed and, consequently, the skills of learning are not readily accessible to those who need to learn how to learn. This is in contrast to skills such as hitting a golf ball which, though complex, can be watched, analyzed and documented observationally. These characteristics of learning make it improbable that either learners or instructors will develop a good understanding of effective learning skills.

The "best" learning skills often vary from student to student and by content to be learned. Due to differences in cognitive and environmental experiences as well as individual variations in interest, motivation, mood, and purpose, to mention only a few personal variables, individual learners may use very different skills to learn the same content. One reason single track study heuristics such as SQ3R do not succeed for all may be because of these internal variations (e.g. see Ford, 1981).

In addition, study is an inductive activity which is difficult to optimize. In most cases, humans do not learn much from experiences where optimal strategies are not obvious. In inductive activities, anything which works (satisfices according the term coined by March and Simon [1958]) reasonably well is acceptable.

There is a good deal of evidence in the decision theory literature to support the notion that people frequently do not learn from experience. For most people, once a reasonably effective solution to a problem is located or discovered, further exploration is abandoned. Consequently, "managers may settle for the first adequate solution they find to a problem. . . rather than search further for the best one . . . searching the haystack for a needle sharp enough to sew with may be better than persevering in the search for the sharpest needle in the haystack" (Ullrich and Wieland, 1980, p. 151).

Similarly, in study, students often find that certain study actions result in acceptable test scores, and satisficing levels of learning. These study actions lead to enough success to "muddle through," often even without the realization that more complete understanding is possible. Because they are successful in not failing, students may not search for more efficient and effective means to learn and master academic content. Having never been exposed to a variety of learning skills, students have little idea of their own potential as learners and the achievement levels possible from purposefully selecting the best learning actions.

For instructors, a similarly pessimistic scenario exists. It is easy to suspect that students do not achieve

because they are lazy, incapable or do not care. After all, most teachers are good learners. However, most instructors did not become good learners because someone overtly taught them good learning skills but because they intuitively discovered good learning habits. At best, most instructors analyze how to learn post hoc and reason that if they did it on their own, so can their students.

Actually, most good learners have difficulty describing how they learn except in the most general terms. Thus, instructors prescribe "more work" or "harder work" or more dedication as remedies for failure. Rarely do good learners realize the variety of skills they employ or the idiosyncratic nature of their own hard work. They also fail to recognize what works for them may not work for others, particularly for students who have worked hard and failed or been less successful than desired.

Thus, it seems that learning to learn well is difficult for many reasons. Good learning habits are difficult to discover; they can be neither seen nor easily imitated because they are private and personal. To compound the problem, success with some skills discourages further exploration since new skills could lead to failure. It is not only easier but a lot safer to dance with "who brung you."

Teachers, too, discourage exploration of how to learn. By exhorting students to work harder, they encourage students to do more of what has resulted in minimal success. Of course, what is likely is that students' extra effort will accrue in relatively little achievement gain. The results are discouraging and frustrating to both students and instructors.

This situation may be best summarized as a failure to understand well what is involved in academic learning. Both students and teachers fail to recognize the complex and unique variables interacting in academic achievement. Perhaps if both comprehended the task well, then mutual benefits could be realized. To illustrate the value of a concept of learning, a brief conception of academic learning, which in part, is based on decision theory and recent analyses of effective learning in higher education, (Ford, 1981; Sherman, in press) wil e presented.

Academic Learning as Decision-Making

I have chosen a decision-making analogy to illustrate academic learning for two reasons. First, decision theory confronts topics such as process and intention in relatively direct and explicit ways. Decision heuristics are recognized as useful, if not always realistic, representations of how to make decisions. More importantly,

however, the role of intention is addressed through concepts such as meta-decisions (Jungerman, 1980) and strategic decisions (Patz, 1981). What seems apparent from this literature is that decision-makers who are purposeful and aware not only of their resources but also of how they make decisions are likely to produce judgments which are more accurate and successful.

Second, a decision analogy seems appropriate because good learning appears to be a decision process. A learner can be considered a resource manager in a way directly comparable to commercial managers. Rather than manage personnel, products, costs, resources, etc., in order to achieve sales and profits; the learner must manage personal abilities and coordinate these with assigned tasks and subject matter to achieve personal learning. This managing function--often referred to as meta-cognition--may be the critical element through which learners can gain control of how much they learn, how well they learn, and how long they remember. First, though, it is necessary to understand what learning resources are available and how they can be related to accomplishing successful learning. That is, before engaging in any management activities, a manager must be familiar with: (1) which variables can be managed, (2) the potential for managerial control, and (3) the possible and probable effects of various managerial actions.

The basic task of learning in higher education involves a similar task of integrating/synthesizing variables internal and external to the learner (See Figure 1 for a visual representation). Internal variables include all the learning resources (characteristics and skills) which may be personally manipulated by the learner to control learning.

Internal variables include personal characteristics (e.g., ability, effort, prior knowledge, style) and learning skills (e.g., notes, outlines, survey, mnemonics). These are the resources the learner has available to learn with and are potentially amenable to selective use and conscious control. As learners increase learning resources and their understanding of these resources, they have more learning options available and a higher probability of success. These resources are the means by which learners attack a learning assignment or external variables.

External variables, content characteristics (e.g., simple or complex, analytic or informational), and task demands (e.g., types of learning, form, style) comprise the characteristics of learning task. Basically, learners must recognize their personal capabilities, understand the nature of what is expected, and coordinate their learning resources with the learning task.

To elaborate, learners enter a learning situation with certain personal learning resources. In general, learners

who have many learning resources, who understand how to use these resources and who understand themselves as learners are likely to be more effective learners. These learning resources are employed to master a learning task, usually assigned to the learners. However, effective application of learning resources requires interpretation of the learning task by the learner. That is, the learner must recognize specific content characteristics and task demands accurately in order to select and activate appropriate learning skills and personal characteristics. The process of interfacing available learning abilities with learning tasks is defined as task definition. This interactive process requires decisions on how to match available learning resources with learning tasks and how to selectively modify each to develop a manageable task definition for the specific learning situation. Next, a study strategy of specifically selected learning skills to master the defined learning task can be decided upon. This last step appears to be the point at which learners creatively organize, manage and monitor decisions about learning.

Learning success is not a function of effective skills alone, but these are necessary elements. As a cognitive activity, learning is an executive function of learners responding actively to learning tasks and deciding which of their learning resources to employ. The executive function

appears to depend upon an ability to interpret accurately learning tasks and match the demands and characteristics to learning resources (characteristics and skills). Consequently, the learner can establish responsibility for personal learning through effective decisions about personal resources and demand characteristics to produce a personal study strategy appropriate for the specific task and content. These study strategies are likely to be different for ev· learner due to varying personal characteristics, learning skills, and decision analyses.

In summary, learners who make active decisions about learning actions or skills (Sherman, 1984) will learn well; those who do not, will learn less well. As a corollary, learners who have and use many learning actions or skills have a higher probability of learning than learners with few skills because they have alternate skills when first attempts fail. Control over learning is dependent upon the quality of decisions made about matching learning resources and task demands. Because learner characteristics and skills are idiosyncratic, it is likely that skill selection decisions and learning success will vary from le.. ner to learner and task to task. However, a broad and comprehensive skills repertoire appears to be necessary but not sufficient for successful, versatile learners. We will now look at the characteristics of a good academic skills repertoire and how these skills may be developed.

Developing a Learning Skills Repertoire

Three characteristics appear to make up an adequate learning skills repertoire which allows learners to respond differentially to changes in external variables by manipulating their internal variables.

First, a variety of learning skills appears essential. Without the flexibility afforded by many skills, learners are intellectually confined to those situations in which their few skills are effective. A mechanic who owns and only knows how to use a screw driver will be successful when screws must be driven. However, the potential for success decreases when hammering and bolting are necessary. On the other hand, a student who has a full box of tools at least has the ability to respond appropriately. It is possible, however, to prefer to use only a screwdriver regardless of the tools available or the task assigned!

In addition to variety in the number of skills, students also a need variety in the types of skills. Study is often divided into three components: preparation, information learning and follow-up (Anderson, 1979). A study skills repertoire should include skills from each component and within each component contain a variety of skill types. For example, in learning information, students should have several skills to organize, recall, review and acquire information (see Sherman, 1984).

Second, a good skills repertoire must include experience. Unfortunately, study skills are quite similar to carpentry tools in at least one way; just knowing tools exist or being shown briefly how to use them does not produce an expert cabinet maker. Similarly, students, after learning about study skills, need focused and long term experience to master these tools of learning. Specifically two categories of experience appear necessary, content experience and task experience.

It is quite possible for students not to consider using some skills in some situations. Much of the research on skills training with children (e.g. Butterfield, Belmont, Wambold, 1973) shows that skills are not generalized to other than the specific conditions under which they were learned. The same is likely true for college students with learning skills taught in a laboratory isolated from real content and real tasks. Habits are difficult to change; when faced with a challenging problem, humans seem to instinctively revert to habitual skills even though they have not produced success. One apparently successful way to address this problem is to orient skills training to the actual content students are studying and to the tasks they are assigned. It should also be noted that these efforts appear most successful when planned longitudinally rather than in short term workshops (e.g. Dansereau, 1978).

Third, a skills repertoire must be accurate in that students must be sensitive to how well they are using skills and how well the skills are working. Skills used poorly will not produce good results. Going through the motions of reading, for example, yields little learning if attention is to an unrelated topic. It is also important to monitor skill selection to assess if the skill is appropriate and effective (e.g. Day, 1980). For example, it is likely that SQ3R style survey will be ineffective and perhaps harmful for a student with low prior knowledge (Williams and Sherman, 1984). Finally, confidence or mood appears important. Several recent studies on mood have indicated that positive attitudes are associated with learning success (e.g., Dansereau, 1978; Ballif and Hettina, 1981).

Thought Modeling to Teach Academic Learning Skills

To prepare students to be versatile learners and to make decisions about learning strategies they must be equipped with a variety of academic learning skills (Sherman, 1983). Academic Learning Skills are the cognitive actions which result in learning and can be grouped in terms of purpose and explicit action. However, as indicated previously, students have no direct access to these skills because they are cognitive and not readily observable.

Further, there is a relatively low probability that a variety of academic learning skills will be discovered intuitively. It is also unlikely that descriptions alone will be successful. For many students, descriptive approaches appear to be too general and non-specific to make accurate implementation possible. Consequently, students often interpret skill descriptions as equivalent to what they ordinarily do and tend not to faithfully implement them. Finally, presenting students with a routine or single track study heuristic (e.g. SQ3R) often fails not only because the descriptions are too general but also because the heuristic applies in relatively few situations. Rather than increase versatility, a five or six step study heuristic restricts learning options and often provides a study approach little better than what students are already doing. In addition, these heuristics often seem to require more time and effort but produce few achievement gains.

To be effective, it appears skill instruction must be explicit relative to the main components of the skill, how to use the skill, when to use the skill, and how to monitor its success. Cognitive or thought modeling appears to provide a potent method to accomplish these purposes. Sarason (1973) described cognitive modeling as "efforts to make explicit for observers the processes by which (the model) arrives at the overt responses he makes" (p. 58).

Significant successes have been achieved in counseling and psychotherapy using cognitive modeling. This research also provides some well developed guidelines for restructuring the cognitive skills of students as they study.

Seven steps were proposed by Cormier and Cormier (1979) to demonstrate and teach new thinking patterns:

1. A verbal set about the procedure
2. A cognitive model of the task and of the self-verbalizations
3. Overt external guidance
4. Overt self guidance
5. Faded overt guidance
6. Covert self guidance
7. Homework

There appears to be considerable research to support these guidelines (Meichenbaum and Cameron, 1982; Meichenbaum, 1977), and they appear applicable with equal potential to restructuring cognitive study actions as with anxiety or depression.

A preliminary step may be appropriate to precede these steps when teaching study skills. All academic learning skills must be identified and analyzed prior to step 1. Of course, academic learning skills have been identified in several ways (Sherman and Wildman, 1982; Sherman, 1984; Weinstein, 1978; Pressley and Lewis, 1983); but, they must

also be carefully analyzed to ensure proper demonstration of the skills. Once the thinking of the skills is explicit and documented, instruction may proceed as follows:

Step 1, Verbal Set: A Verbal Set prepares students to learn academic learning skills in two ways. First, learners can be familiarized with the general purpose and nature of academic learning skills. This should sensitize students to the potential control they have over their learning and how this control can be exerted through effective decisions about skill use. Pask (1976) reported that students who possessed this awareness or metacognitive control were more successful learners.

Second, a Verbal Set prepares students to receive and use cognitive models. Most find the idea of thinking aloud strange and we rarely consider patterning our own thoughts after a model. We tend to consider our thoughts private and unavailable for change. This is an important hurdle to overcome so that students are receptive to this form of learning. In general, students must be convinced they should "think" or talk to themselves exactly like the model.

Step 2, Cognitive Model of Skill and Self Verbalizations: Two important points in this step are to present an explicit model of the skill and to model also the thinking through which the skill is implemented. Being "explicit" appears critical to success. Thus, the skill,

its main components and purposes must be clearly described. In example 1, a description of one kind of survey is illustrated.

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EXAMPLE 1 HERE.

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Also, the cognitive activity must be modeled in a realistic and explicit manner. Both direct and written models appear effective and making them explicit often requires that the purpose of each element of the model be identified. In the example below, part of a written model to teach the survey skill described above is presented. Notice that the left column is used to connect the elements of the skill with their implementation in the model, in this case to five suggested survey questions.

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EXAMPLE 2 HERE.

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Finally, it seems best to employ coping instead of mastery models. A flashy, error free model is not only difficult to imitate but also discouraging and unrealistic. Consequently, it is wise to include errors and misstatements to increase realism and to demonstrate how to handle these in an actual study situation. To maximize success it appears important that the model include: (1) an intention

or purpose statement (2) planning in response to the purpose (3) self-guidance statements (4) coping or correcting self-evaluation, and (5) self-reinforcement. The numbers, included in this model for illustration only, identify these components in this example.

Step 3, Overt External Guidance: Here students practice the skill outloud with corrective guidance. This "coaching" should focus on the main elements of the model and accurate imitation. For example, with survey, students should be coached to survey all topic markers with overt thought models. For example:

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EXAMPLE 3 HERE.

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The purpose of this step is to lead students into and toward competent performance of the skill.

Step 4, Overt Self-Guidance: Students are instructed to use the skill as demonstrated and practice while thinking outloud. The expectation is that they know the skill well enough not to need frequent guidance. Thus, the purpose of this step is to provide practice and assess progress. A return to a previous step may be necessary and advisable depending upon performance. Students should be encouraged to use their own words to perform the skill accurately and to verbalize each of the five elements in their thought

model. Overt practice provides an opportunity to give feedback to students and to decide if additional guided practice is needed. An important point here is that students should use the actual texts they are studying to develop skills to enhance the realism of the skill.

Step 5, Faded Overt Self-Guidance: In this step students are released to more independent skill practice. The idea is to begin the process of self-control over the skill and to guide the process of the skill personally. For many students, this step may be optional as they may be uncomfortable with it. Students should be asked to practice the skill while "thinking in a whisper" rather than out loud as in the previous step. This step does provide instructors with another opportunity to "see" the skill in operation to assess how accurately the skill and the five behavioral components of the model are being rehearsed.

Step 6, Covert Self-Guidance: In this step students are put on their own to practice the skill. Inform students that their thinking, though silent, should be exactly the same as during the earlier rehearsals. Actual text materials should be employed and the results of the skill should be examined. For example, if the skill taught is survey, students should reconstruct the prereading schemata they developed and these schemata should be compared to the author's schema (see Williams and Sherman, 1984). The match

between the two schemata should then be examined for accuracy and potential problems. As another example, with an organizing skill such as outlining, performance could be assessed by reviewing students' outlines and comparing them to an expert outine.

Step 7, Homework: A critical factor in successful skill use is how well it is implemented outside the training situation. Consequently, students should be assigned to employ the skills learned in their regular study. This assignment should not be general or non-specific such as "Remember to do this tonight." The assignment should be specific and direct. For example,

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EXAMPLE 4 HERE

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It may also be useful to have students make notes about problems and successes encountered while using the skill on their own. These may then be resolved at the next instructional session.

Several additional points should be noted when using this procedure. First, there is considerable evidence that this approach is effective in cognitive therapy (e.g. Miller and Berman, 1983) and in other cognitive restructuring situations as well. Case (1978), for example, reported a similar set of experiences as part of a neo-Piagetian task

training example. Second, academic learning skills can be taught individually and in groups. Group rehearsal can be carried out in unison or in private. Also, students may work in pairs listening and practicing in turn as they practice skills. Third, with some students it may be necessary to contrast effective with ineffective skills. This holds particularly for students who have little awareness of how they learn or that there are a variety of ways to learn. Finally, teaching academic learning skills is but one component of a successful learning improvement program. Mood and attitude control, test taking competence, self efficacy, general student behaviors, and executive cognitive control must also be taught. However, for skills training, thought modeling appears to be an effective and efficient technique.

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Appendix 1

An Example of an Introduction for a Thought Model

Survey Questions

Survey skills help you make judgements about your own knowledge, the material you are studying and how to best learn the material. Asking the following questions during survey will usually provide enough information to make survey judgments.

Survey Questions

1. What does the author want me to learn from this material? (Purpose)
2. How much do I already know about this topic? (Present Knowledge)
3. What important words, facts, relationships or comparisons will I need to learn. (Need to Learn)
4. How interesting is this material? (Interest Level)
5. How difficult is this material? (Difficulty Level)

These survey questions will be referred to in every survey skill. In addition to these, any questions which you can ask as you survey which allow you to anticipate or preview what you will learn will help you also.

Appendix 2

An Example of a Survey Thought Model for Survey

The topic markers from a 23 page chapter in an earth science textbook are listed below. These topic markers appear on different pages throughout the chapter, but are listed here without the text to demonstrate how much you can learn about the material and how to learn the material from only surveying the topic markers. Carefully read these topic markers asking yourself the survey questions as you read.

The Changing Atmosphere*

1. Water Vapor in the Atmosphere

   Humidity

   Dew Point and Relative Humidity

2. Precipitation

   Clouds

   Nuclei for Droplets

   Droplets to Drop

   Moving Water

3. Heat in the Air Ocean

   Heating the Air

   Molecules

4. Pressure in the Air Ocean

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*From: Brandewein, P.F.; Brovey, D.J.; Greenstone, A.W.; Yasso, W.E. Matter: An Earth Science. New York: Harcourt Broce Jovanovich, 1975.

The Pressure of Air

Heat, Water Vapor, and Pressure

5. Relating the Concepts

Notice, that the topic markers are not of equal importance (often indicated by different sizes of the type). In this way the author can show how topic markers are related to other topic markers. This use of topic markers shows the organization of the topics included.

For example, in this chapter, "Water Vapor in the Atmosphere" includes under it the topics of "Humidity" and "Dew Point and Relative Humidity". This author is telling you that water vapor in the atmosphere can be explained by or includes the concepts of humidity and dew point and relative humidity. As you study, look for an explanation of how water vapor in the atmosphere includes humidity, dew point and relative humidity. These relationships are important in order to understand the topic.

For example, on a test question on atmospheric water vapor you could demonstrate your understanding by relating humidity, dew point and relative humidity as components of atmospheric water vapor.

Now, look at the thoughts of a student below to see how she used this survey skill. As you read the student's thoughts, remember that your thinking should be like this student's when you use this survey skill.

Appendix 3

Continutaion of the Thought Model in Example 2

Survey Questions	Student Thoughts
Need to Learn	This section includes "Clouds" and "Nuclei for Droplets," I wonder what in the world that means, Nuclei for Droplets?" "Droplets to Drops" is the next sub-topic.
Need to Learn	I don't know anything about that. I will have to read this carefully.
Difficulty	So far this seems pretty interesting and probably not too difficult.
Need to Learn	The next topic is called "Moving Water." I don't have any idea about this sub-topic. This chapter is not about oceans. It must refer to water moving in the air somehow. It sounds strange.
	The next sub-topic is called "Heat in the Air Ocean."
Interest	Well that's interesting, they're talking apparently about the air as though it were a water ocean.
Present Knowledge	We just studied oceans so I can probably use some of the concepts I learned in the previous chapter with this one if I think about the air as an ocean.
	"Heating the Air" is the next sub-topic.
Need to Learn	"I guess we will find out why the air is warm sometimes and why its windy and so forth.
Present Knowledge	"Molecules of Expanding Air" is the next topic. I remember in physics we talked about how when a

gas is heated it expands so this must be something about how air expands and contracts; maybe that has something to do with air pressure.

Well, the next topic is "Pressure in the Air Ocean." Maybe the previous section doesn't have anything to do with air pressure. Maybe it's something else.

Purpose — The first sub-topic is, "The Pressure of Air," I guess I'll find out something about where pressure comes from and what it means.

Need to Learn — "Heat, Water Vapor and Pressure" is the next sub-topic. Well, maybe all of these contribute to how much pressure there is in the air.

Present Knowledge — Maybe, this might be barometric pressure that they talk about on the news sometimes.

Purpose — The last major topic is called "Relating the Concepts." This must be a summary section to help tie all of these different sub-topics together and help me understand how all of these different topics relate to each other.

SUMMARY

present Knowledge — Well in general, there are a number of things that I have heard of before in this chapter but I really don't know the scientific explanations for these topics.

Need to Learn — There are some important words like humidity and pressure that I need to watch out for. I also need to find out what this air ocean is about.

Purpose — I think the author wants me to understand how all of these various

topics fit together that result in changes in the atmosphere and weather.

Need to Learn — I'll have to look for that as a major purpose of the author.

Interest/Difficulty — The material looks interesting but I don't think it will be too difficult.

Appendix 4

An Example Thought Model of Survey

Chapter Topic Markers

Some Simple Chemistry

1. The Elements
   - A. Elements Important in Biology
   - B. Atomic Structure
     1. The Atomic Nucleus
     2. The Electrons

2. Chemical Bonds
   - A. Ionic Bonds
   - B. Covalent Bonds
   - C. Hydrogen Bonds

3. Some Important Inorganic Molecules
   - A. Water
   - B. Carbon Dioxide
   - C. Oxygen

4. Some Simple Organic Chemistry
   - A. Carbohydrates
     1. Simple Sugars
     2. disaccharides
     3. Polysaccharides
   - B. Lipids
     1. Fats
     2. Other Lipids
   - C. Proteins
     1. The Structure of Proteins
     2. Determining the Structure
     3. The Three Dimensional Configuration
   - D. Nucleic Acids

5. Chemical Reactions
   - A. General Conditions for Chemical-Reactions
   - B. Catalysis

Below are the thoughts of a student while surveying the topic markers above.

Survey Questions	Student Thoughts
READ TOPIC MARKERS	
	I will begin by reading the chapter title, "Some Simple Chemistry".

	Oh no, having o take Biology is bad enough, let along having to study Chemistry too. I don't know anything about Chemistry. Let me see what some of the topic markers in this chapter are and if I recognize any of this stuff.
Present Knowledge	
Need to Learn	"The Elements," boy, I don't even know what an element is. "Elements Important in Biology." Whatever elements are, I guess they're important to Biology.
Difficulty/ Need to Learn	"Atomic Structure," wow! "The Atomic Nucleus." "The Electrons," gosh! I really don't know any of this stuff.
Present Knowledge/ Need to Learn	The next topic is "Chemical Bonds." Maybe chemical bonds are the way elements are held together, I don't know.
	"Ionic Bonds." There must be different kinds of bonds.
Difficulty	I think there must be at least one other kind, "Covalent Bonds." This looks like difficult material.
Need to Learn	"Hydrogen Bonds," well I guess there are three different kinds of bonds.
	The next topic is, "Some Important Inorganic Molecules." There must be two kinds of molecules, organic and inorganic.
Present knowledge	Maybe, these are inorganic molecules.
Need to Learn	"Water," I wonder what the difference between an organic molecule and an inorganic molecule might be.
Need to Learn	When I read the chapter I will have to look for that.
Present Knowledge	"Carbon Dioxide," "Oxygen," well oxygen is something that I recognize. We breath oxygen. Oh, sure enough, the next topic is

	"Some Simple Organic Chemistry." This must be another kind of chemistry other than inorganic.
Present Knowledge	The next topic is "Carbohydrates." I believe that has something to do with sugar. Oh, yes, the first topic is "Simple Sugars."
Need to Learn	I wonder if there are also complex sugars.
Need to Learn	The next topic is "Disaccharides." I wonder what that is.
Difficulty	The next topic is called "Lipids." I have no idea what that is.
Present Knowledge	"Fats," fat must be a lipid I guess because it is a sub-topic under "Fats."
Need to Learn	The next topic is, "The Structure of Proteins." I wonder how all this stuff fits together.
Need to Learn	The next topic is "Determining the Structure." The structure of what?
Difficulty	The next topic is, "The Dimensional Configuration." This material really looks hard.
Need to Learn	This next topic is called, "Nucleic Acids." I don't know what that is either.
Need to Learn	The next major topic is called "Chemical Reactions." Maybe this explains how all these other things are formed.
Present Knowledge	"General Conditions for Chemical Reactions" is the next topic. It should be pretty clear in that there are some conditions which must be available for a chemical reaction to take place.
	The next sub-topic is called "Catalysis. Maybe that is one of

	the conditions that must be available for a chemical reaction to occur.
SUMMARY	
Need to Learn/ Present Knowledge	Wow, I don't know any of this material! I'm not even sure of what I need to learn.
Difficulty	I looks very difficult and very complicated. I'm sure these terms must be very important.
Purpose/Need to Learn	The point of this chapter must be to understand how chemistry is somehow related to biology but I sure don't know what this relationship could be.

Example 1

An Example of a Written Description of an Academic Learning Skill

Survey Skill: Read Topic Markers

Most textbooks contain topic markers. These are the words, phrases and sentences that are printed in a type different from the majority of the material. Usually topic markers are printed in larger or darker type; chapter titles, titles of subsections in a chapter, words in italic type, graphs, maps, and figures are all examples of topic markers. These topic markers are included by the author to help identify the important ideas, comparisons and relationships which will be discussed in the material.

Description

Begin by opening your book and looking for topic markers. The chapter or section title should be the first topic marker you read. Ask yourself the five survey questions quickly as you look for the next topic marker. Look also for relationships between topic markers such as topic markers which are subtopics of another topic. Continue to search for topic markers and answers to the survey questions until all pages in the material have been surveyed. Finally, when all topic markers have been read briefly, review in your mind the answer to each of the five survey questions.

Example 2

An Example of a Student Thought Model

Survey Questions	Student Thoughts
READ TOPIC MARKERS	
	I will begin by reading the topic markers. The title of this chapter is "The Changing Atmosphere."
Purpose	This chapter is one of three in a unit on the earth's air and water.
Present Knowledge	The last chapter was on the seas and oceans so this one must be on the air.
Need to Learn	I don't really know a whole lot about the air except what I hear on the weather about humidity and air quality and so forth.
	I will continue looking at some of the other topic markers.
Present Knowledge	The first is "Water Vapor in the Atmosphere." That must refer to humidity. Yes, "Humidity" is the next sub-topic.
Need to Learn	This must give information about how the air becomes more or less humid.
Interest	This should be pretty interesting.
Present Knowledge	Next is "Dew Point and Relative Humidity." I heard both of those on the weather reports.
Need to Learn	I never did know how the dew point was calculated, I never even knew what it was.
Purpose	The author probably wants me to learn what dew point is; maybe I can find out by reading this.
Interest	That'll be interesting.
	The second major topic is "Precipitation." I think that refers to rain.

Present Knowledge	I suppose this section is about how rain occurs, and what makes rain.

Example 3

An Example of Correcting an Error During External Guidance

Instructor	"You see there is also a map at the bottom of the page. What should you do with the map?
Student	Survey the map also.
Instructor	You might think like this."
Instructor	"Oops, I forgot the map. I'd better look at it, too. This is a map of Africa which shows the location of natural resources? I guess I'll have to learn which areas are rich and which are poor in resources. I don't know much about Africa so I'll have to pay close attention; it should be interesting, though.

Example 4

An Example of a Homework Assignment

Instructor: "What will you study tonight?"

Student: "History"

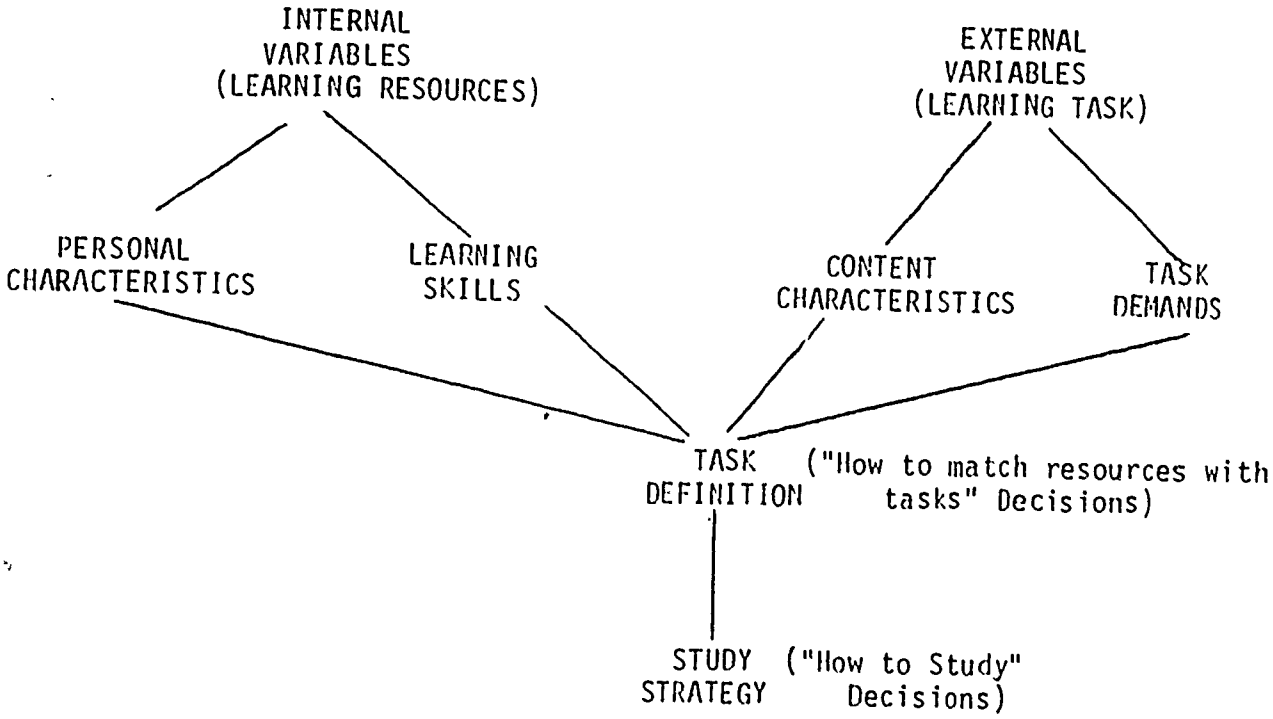
Instructor: "Then survey before you read analytically." What chapters will you read?"

Student: "I guess 15, 16 and 17."

Instructor: "Why not just read 15, read it well and survey, first. Be careful to think just as you have rehearsed here. After you survey, review how well you have surveyed. Did you ask the five survey questions and were you able to answer them? Did you feel prepared to read?"

FIGURE 1

A REPRESENTATION OF ACADEMIC LEARNING AS DECISION-MAKING



Adapted from Sherman, T.M. "Learning Improvement Programs: A Review of controllable influences," The Journal of Higher Education, (in press).